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ABSTRACT

This paper, based on an interactive session, offers the perspectives of three male professors, all of whom teach science methods classes consisting primarily of female prospective teachers. These three men have engaged the matter of gender-inclusive education in their classrooms and have struggled with the ramifications of that engagement. It is a commonly held belief that male professors approach women's issues from a distinct point of view that is developed through the interaction of influences from families, friends, teachers, professional literature, and the social context. The participants in this interactive session shared insights they gained from investigating gender dissonance within their own professional lives which cover different institutions of higher learning and different time periods. The goal of this session was to provide the basis for the conversation about male science education professors, gender-inclusive education, female prospective science teachers, and avenues of research to construct a more complete understanding of the situation. Contains 30 references. (JRH)

Teaching Science Methods to Women:

Three Tales of Men Professors Reflecting On Their Practices

An Interactive Session in the Cultural, Social, and Gender Issues Strand

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A symposium presented at the annual meeting of the National Association for Research in Science Teaching, Oak Brook, IL, March 21-March 24, 1997.

Abstract

This interactive session offers the perspectives of three men professors, all of whom teach science methods to classes consisting primary of women prospective teachers. These three men have engaged the matter of gender inclusive education in their classrooms and have struggled with the ramifications of that engagement.

It is a common insight that men professors approach women issues from a distinct point of view. This is a point of view that we have gained through the interaction of influences from our families, friends, teachers, professional literature, and social context in which we have lived. The participants in this interactive session share insights they have gained from investigating gender dissonance within their personal professional lives which cover different institutions of higher learning and time periods. The goal of this session is to provide the basis for conversation about men science education professors, gender inclusive education, women prospective science teachers, and avenues of research to construct a more complete understanding of the situation.

Teaching Science Methods to Women:

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Overview

This interactive session offers the perspectives of three men professors, all of whom teach science methods to classes consisting primary of women prospective teachers. These three men have engaged the matter of gender inclusive education in their classrooms and have struggled with the ramifications of that engagement.

It is a common insight that men professors approach women issues from a distinct point of view. This is a point of view that we have gained through the interaction of influences from our families, friends, teachers, professional literature, and social context in which we have lived. The participants in this interactive session share insights they have gained from investigating gender dissonance within their personal professional lives which cover different institutions of higher learning and time periods. The reactants speak to these insights and offer additional thoughts from their positionalities. The goal of this session is to provide the basis for conversation about men science education professors, gender inclusive education, women prospective science teachers, and avenues of research to construct a more complete understanding of the situation.

Background and Rationale

The field of science education is grappling with the enactment of success for all in classes characterized by diversity. A well established body of research within the science education research community documents the inequitable education of girls in most science classrooms (see, for example, Kahle, 1990; Skolnick, Langbort, & Day, 1982; Weinberg, 1995). Researchers such as Harlan & Rivlin, 1996; Kahle, 1990, Kahle & Meece, 1994; Rossner, 1990; Sadker & Sadker, 1994; Shephardson & Pizzini, 1992; and Tobin, 1987 have alerted the science education community to the critical realm of teacher- learner interactions and expectations

to remedy this inequity. Their findings include that males are favored in science lessons by their teachers at all levels while females are discouraged; girls are likely to receive fewer verbal and social encouragement cues from the teacher than the boys to answer science questions, contribute to science discussions and persist at experimenting; and most elementary teachers perceive males as more cognitively intellectual than females.

Other researchers (see, for example, Sadker, Sadker, Fow, & Salata, 1993, 1994; Blake, 1993; and Kahle, 1990) have focused on the critical realm of representation and roles of women in science materials and in the learning environment. Their findings include that girls and women are typically slighted in science materials and in cooperative learning groups; that science materials tend to portray science and careers in science as masculine through the omission of feminine role models and by overly depicting men as scientists; and that in cooperative learning groups, girls have been overly represented as recorders of data or readers while boys are allowed to control the science equipment.

Still another group of researchers, (see, for example, Corey, van Zee, Ministrell, Simpson, & Simpson, 1993; Harlan & Rivlin, 1996; and Hykle, 1993) focus on the role of inclusive science classroom discourse. Their findings include that talk in the science classroom can discourage girls while encouraging boys; that the exclusive use of the masculine pronoun to refer to a generic scientist, or the use of "you guys" to refer to students of both gender fails to support girls participation in science; and that instances when books and teachers characterize girls as afraid of snakes and spiders while portraying boys as inquisitive explorers is thought to discourage girls in science.

A research area that has not been adequately investigated is women prospective teachers of science primarily being taught by men science professors. Does the gender of the science methods professor affect how prospective women teachers of science envision their own role in teaching science? How do men professors of science education come to grips with the contradiction between promoting success for all and encouraging gender equity in science teaching when their profession is not gender representative of the population they teach? What

steps do men professors of science education take to promote gender inclusive education in their own practices and what impact does this have on their classes consisting primarily of women? These are examples of important research questions of which there are a dearth of reported studies.

Symposium Participants and Reactants

Participants

J. Randy McGinnis is an assistant professor of science education at the University of Maryland, College Park. His area of expertise is elementary/ middle level science education. He teaches both undergraduate and graduate level elementary science education classes consisting primarily of women. His teaching experience as an instructor of elementary/middle science methods spans 5 years at two major state universities.

Kenneth Tobin is a professor of science education at Florida State University. He is involved in science teacher education at graduate and undergraduate levels, including courses on the teaching and learning of science, science curriculum, and science teacher education. He has been involved in science teacher education for 23 years and has taught science education in two major universities in Australia and two major universities in the United States. Prior to becoming a teacher educator he was a high school science teacher for 10 years and a developer of curriculum materials for high school science teachers.

Thomas R. Koballa, Jr. is a professor of science education at the University of Georgia. He teaches both undergraduate and graduate elementary science methods classes. His teaching experience as an instructor of elementary science methods classes spans 15 years. He has taught elementary science method classes at 1 private college and at 3 major state universities in the U.S.

Reactants

The reactants to this session are women researchers in science educators with expertise in gender research. They were selected for invitation to this symposium as reactants upon nomination by the symposium participants. Those who agreed to serve as reactants for this session.are the following: Dale Baker, Arizona State University; J. Denise French, Kansas State University; Sherry Nichols, University of Texas; Leonie J. Rennie, Curtin University of Technology; Leslie Parker, Curtin University of Technology; and Kate Scantlebury, University of Deleware.

Participant Statements

J. Randy McGinnis

I have been active over the last five years in equity research in science education. I have regularly presented research at the major science education research conferences on multicultural education, and I have published multicultural science education studies in both book and journal formats.

In the fall 1995, I began an action research study in which a woman co-researcher (Marjorie Pearsall, University of Maryland, College Park) and I investigated the gender dissonance between me and my women elementary methods students (McGinnis & Pearsall, in review). This is the study in which I will ground my discourse during my participation in this session.

The impetus for my self-study began at one defined point in space and time. I was sitting at the conference banquet at the annual convention of the Association for the Education of Teachers in Science (AETS) held in Charleston, West Virginia, in January, 1995. I looked around the room and saw hundreds of individuals responsible for the education of teachers of science. I felt welcomed and honored to be included in a group whose work I believe is important and meaningful. Suddenly, I had an epiphany. I thought, this group predominately consists of men while my teaching experience on the collegiate level suggests that the prospective

teachers in elementary methods courses are predominately women. Why is there this gender dissonance? What implications does that have on my ability to promote inclusive, multicultural elementary science education? I resolved to study this using action research (Carr & Kemmis, 1986; Collins, 1995) with my next elementary science methods class.

During the fall semester 1995, I implemented ideas suggested by gender equity theorists to role model gender equity in science teaching. At the same time, my co-researcher interviewed both men and women prospective teachers in my class to gauge their perspectives of my effort to acknowledge the gender dissonance and to role model gender inclusive practices and to document the prospective teachers' perspectives of the gender dissonance between me and my class consisting primarily of women. An analysis of the data using an action research methodology led me to the following refection's on prospective teachers' perspectives on the gender dissonance between women prospective teachers of science and men professors of science methods.

My study impacted my thinking in several ways. I gained further insight into myself, this generation's female intending elementary teachers, and my female co-researcher. I now realize that many college students who go in to the profession of education do not immediately find the current gender distribution of educators on the various school levels as being noteworthy. It was no real surprise to any of the women in this study that most teachers and principals in the early grades are women, while at the other end of the education spectrum (at the college and university level), there is an overwhelming concentration of men. None of the intending teachers questioned this arrangement, and were not bothered by it at all. Most of the students did report observing or experiencing some form of gender inequity somewhere along the course of their education, but were not radicialized by the occurrence. Many of the women felt that female science teachers taught somewhat differently than male teachers of whatever education level, and yet this was not an item of apparent concern to them. For example, a commonly expressed belief was that their female science teachers promoted a more "nurturing environment" than men teachers by being less structured, less lecture-oriented, more encouraging

of classroom interaction, and more easy to approach. This was in contrast to another expressed belief by some of the women that they preferred a male teacher because they had better experiences with them than with women teachers. None of the intending teachers voiced any concern about the limited number of women who were found in positions of elementary education leadership in their university. There was a strong cognizance of experience being a necessary component in the qualifications of the ideal science methods professor, but no overt mention of the gender of this individual by any respondent.

The implications and conclusions my co-researcher and I saw from this action research study follow. To begin, I was relieved that my female students believed they benefited from my instruction. My worst fear was not realized: the gender dissonance between me and the women in my class was not disruptive to their science methods mastery or to their growth in confidence in teaching science to young learners. I came to realize that while I could not serve women in my science methods class as a gender role model in science teaching, I could serve as a teacher role model. This was a meaningful realization.

My co-researcher and I came to recognize that "gender is what culture makes of sex" (Keller, 1986, p.122) and that both I and my students have been encultured in a male dominated system. However, the women in this study suggest that it is possible to be male instructor and yet display and accommodate characteristics that promote a friendly classroom climate for women. These actions can obviate the gender dissonance while providing a role model in gender inclusive teacher actions.

We now understand that women in the elementary science methods classes may not have reflected on the issue of gender equity, their own inequitable experiences in science, or the importance of their commitment to be gender inclusive. As a result, their lack of awareness may be one cause for their resistance to spending effort on this issue or seeing it as valuable. Taking the effort to familiarize them with the gender issue in science therefore has merit but may be interpreted by intending teachers in unanticipated ways.

We prefer to entice rather than dictate changes in attitudes, beliefs, and behavior involving gender inclusive teaching practices. Modeling gender inclusive practices in science lessons, identifying sexist teaching practices, and discussing the reasons for instituting non-sexist teaching practices with intending teachers is considered more persuasive and compatible with a professional teacher education program.

We believe that intending teachers of science need to become informed of gender discriminatory actions so that they can avoid them in their own teaching practices. Future teachers should recognize that because girls and boys enter science classrooms with different prior socially constructed experiences and expectations, it is not satisfactory to treat both genders identically. For example, women should be proactively engaged in the science methods classes to assume roles which have traditionally been deferred to males: leaders in small cooperative learning groups, handlers of science equipment, active science experimenters, and scholars in science content. Future teachers should be informed that research indicates that men and women teachers interact twice as frequently with boys than girls in science classrooms (Spear, 1984). Both men and women intending teachers need to see that their science methods professor is committed to helping them learn how to equitably share roles and time between males and females in their future elementary science lessons.

We concede that actions taken in the elementary science methods courses and even in elementary science classrooms to address gender inequity are struggling against the current status quo. We further concede that the long-term consequences of doing this are uncertain. We are committed, however, to being proactive in gender equity within our personal spheres of power and recommend encouraging our intending teachers to do the same.

In response to the tension expressed by prospective teachers who are uncomfortable acknowledging student gender differences, we are guided by advice adapted from Valli (1995): Teachers of science must both see and not see student differences. While gender does not "singularly define any two people in the same way" (p. 126), gender is something that does

contribute to one's view of the world in a given context. It also is something that teachers must deal with if their pedagogical relationships with their students are to be perceived as equitable.

This study does raise the issue, however, that this act of gender dissonance tolerance among women is tentative, even in the best of present day situations. As time passes and sociological conditions change, women may very well not be as tolerant. Giroux (1992) emphasizes that when he states that "pedagogy is a form of cultural politics" (p. 3) that is open to change as new awareness arises and the power configurations change in society. Therefore, male science educators should recognize their presence in elementary science methods courses primarily populated by females as a privilege that is a result of large scale sociological factors which have differentially promoted males and females. Traditionally, women have been discouraged from obtaining college science degrees (Gilligan, 1982, Tobias, 1990), entering doctoral programs in science education, and obtaining instructor positions in science teacher education but have been encouraged to pursue careers in elementary teaching (Tyack, 1974). Males have not been encouraged to pursue elementary teaching careers but have been encouraged to pursue science degrees and positions in science teacher education. These conditions are now being challenged.

We believe that most intending elementary teachers are similar to the participants in this study in not recognizing these iniquities. We firmly believe that they should be if the cycle of inequity in science teaching and learning for females is to be broken.

Kenneth Tobin

I have undertaken research on equity issues as a part of on-going research on teaching and learning for more than a decade. My present interests have evolved from initial studies of females and their roles in science classrooms to interpretive investigations in which the gender of participants is disaggregated by sociocultural factors such as access to economic capital, native language, and ethnicity. Whereas the sex of an instructor may well constrain the interactions that occur in courses on the teaching and learning of science education I believe that the gendered

nature of the discourse that occurs in those communities of intending and practicing teachers are of critical importance. What is of greatest importance in the preparation of science teachers is to construct and maintain learning environments in which participants can co-participate via the agency of a shared as negotiated language. By accessing and appropriating a shared language power differentials can be minimized and all participants, irrespective of their sex, can engage in the activities of the community in such a way that they can facilitate progress toward the attainment of their goals. Thus, an important question relates to the characteristics of the discourse as is evident in being able to access and appropriate a shared language. This is not only a question for researchers, for others to consider while we maintain a status quo. On the contrary, it is an imperative for all science teacher educators to be researchers in their own classrooms such that they can undertake critical reflection on their own practices. If we are to mediate in the efforts of intending and practicing teachers to become better science teachers it is important that active research programs be established to promote and constrain critical reflection. There will be no grand narratives to guide all methods classes in all universities. On the contrary, the solutions will be particularized to institutions and professors, to groups of students. Perhaps it has been the search for grand narratives, a futile search for a non-existent Holy Grail, that has made it so easy for us to be where we are right now, and to stay there. If science teacher educators can see the particularity of problems to their own situations, while at the same time acknowledging their place in a larger community of science teacher educators then we can set in motion a discursive relationship between what works, for example with my classes in my university, and what works elsewhere.

Thus I see the solutions to the problems I perceive as being closely tied to research. This is not business as usual for NARST members but a different form of research and different notions of generalizability. Just as it is an imperative for scientists to reconsider their place in a world of post-modern thinking so it behooves science educators to examine the gender equity issues that persist through the lenses of post-modern thinking. To dismiss post modernism and a slippery slope to mediocrity might be to continue a search for an elusive cup of gold.

Thomas R. Koballa, Jr.

How does the gender of the science methods instructor affect prospective elementary teachers' visions of their own role in science teaching? I first asked myself this question as a twenty-six year old graduate student after only a week of teaching my first elementary science methods class in the Spring of 1980. The class was all females! Most were eager to learn how to teach science to children, but admitted that they didn't know much science. They told me how they had successfully avoided all but the mandatory science classes both in high school and at the university. As a novice methods course instructor, I relied on my experiences as a part-time nursery school teacher and as a secondary certified biology major to help the students learn about children, science concepts, and science teaching and learning. In a sense, we taught each other that semester. They taught me something about teaching elementary science methods, and I hope I taught them something about science and children. My being a male never entered into our discussions or seemed to affect our class activities. I sensed that the women students took for granted that science methods instructors would be males.

My comfort in teaching elementary science methods classes increased substantially over the next decade. I spent more time in elementary classrooms observing and teaching science lessons to children. I sought guidance from some excellent elementary teachers, both male and female, and was mentored by several superb instructors of elementary science methods classes. In my own teaching, I promoted hands-on and minds-on science, inquiry, and success for all. Gender equity was not a topic that I addressed aggressively in elementary science methods classes nor was it one that students, most of whom were female, asked about. I often had my students draw pictures of scientists and science teachers at work and we analyzed their drawings for stereotypic thinking. Students often linked their interpretations of the pictures to their future practices as elementary teachers, but I don't ever recall the students' questioning practices in the methods class based on the drawing experiences.

My first systematic look at issues of gender equity in elementary science

methods classes was prompted by a female graduate student. In 1992-93, she introduced me to the work of Belenky, Clinhy, Goldberger, and Tarule (1986) on women's ways of knowing. This work coupled with my own growing interest in emancipatory education and personal empowerment led us to investigate dilemmas and related decisions we made as co-instructors of an elementary science methods class. The class was composed of 16 females who ranged in age from 20 to 40 years. One of several dilemmas explicated by this study is reflected in the question: Whose approval is more important--the instructor's or that of the students? During the class, the students frequently deferred to me as the professor to make the final decisions about class activities and assignments. Our desire was for them to take ownership of their own learning and in taking ownership to make their own decisions and to feel comfortable with them. Our interpretations of the students' actions were undergirded by Belenky's model of women's ways of knowing. In Belenky's words, our students were "received knowers." They expected to be told what to do; they resisted viewing me as an equal partner in the decision making process. I saw the students' actions as disempowering. They relied on me, the male instructor, to make the final decisions about what they should learn, even though they had strong ideas about what they needed most to be successful teachers of science to children.

Based on the findings of this study and further reflection, my personal goal became to help the female students in my elementary science methods classes move along the developmental pathway suggested by Belenky's model.

My judgment is that most of the students come to the class as received knowers, that is they view themselves as recipients of knowledge, but incapable of constructing knowledge on their own. My desire is that they come to view themselves as creators of knowledge through the use of intuitive as well as objective procedures. This desired state can be achieved, according to Belenky and her colleagues, by engaging in connected teaching. Connected teaching in an elementary science method class involves helping the students realize that science is a human construction, that all that is written in textbooks and recorded on video tape is not to be accepted at face value, and that conversations in science classes are usually not about facts but about

models and theories. In the connected classroom, students are comfortable with uncertainty and knowledge is constructed through consensus. The connected teacher is not the voice of scientific or pedagogical authority, but one who, much like the students, struggles to make sense of the world of elementary science teaching and learning. Belenky and her colleagues clarify the teacher's role by comparing the metaphors of teacher as midwife in the connected classroom and teacher as banker in the traditional classroom. "While the bankers deposit knowledge in the learner's head, the midwives draw it out. They assist the students by giving birth to their own ideas, in making their own tacit knowledge explicit and elaborating on it" (p. 217). While I have difficulty seeing myself as a midwife, I nonetheless attempted to transform my elementary methods classes into connected classes during the 1995-96 school year. I based my transformation on the ideal of feminist science described by Bentley and Watts (1986). Feminist science, according to Bentley and Watts, is based on a philosophy of wisdom rather than knowledge. This philosophy of wisdom takes into account the personal, social, and creative aims of the individual and is reflected in investigative approaches that embrace subjectivity. Based on this approach, I designed my science methods class to allow for considerable learner autonomy, include opportunities to explore multiple views of science and science teaching, and to emphasize personal feelings and intuition as important to developing science and pedagogical understandings.

Analysis of my personal notes based on interviews conducted with 54 students near the end of three elementary science methods courses taught in consecutive 10 week quarters during the 1995-96 school year led me to the following findings:

- Students' participation in class activities and understandings constructed as a result of the elementary science methods class are not adversely affected by a male instructor. The students expect, and in some instances demand, to be taught as they have been in other classes. As one students told me, "We're use to dealing with men teachers in science. All of my science teachers except for one since high school have been men."

• Students find readings and class discussions intended to challenge their conceptions of the nature of science to be of little value. Most firmly believe that science is a universal form of knowledge that transcends feminist interpretations.

• Students wish to learn about instructional strategies that can help them engage girls and boys equally in elementary school science. Ways to detect and limit unintended biases in science (e.g., calling on boys more than girls, allowing boys to dominate lab groups) are topics of high interest.

• Students want to know about textbooks and other instructional materials that tell how science lessons can be structured to ensure equal opportunities for girls and boys in science. They also want information about resources that describe the scientific contributions of women.

Based on my findings, elementary science methods as operationalized in the connected classroom is not an effect model for me and my students at this time. Elementary science methods classes structured in a way that resembles what Bentley and Watt (1986) call girl-friendly science or feminine science may better match the needs of my students. In the women-friendly (rather than girl-friendly) elementary science methods class, the instructor would make traditional science teaching more attractive to women by changing the image of science and science teaching presented in science classes. Challenging stereotypes, emphasizing the aesthetic appeal of science and science teaching, and framing the science methods curriculum in a social context are all examples of ways to make science methods more women friendly. Feminine science methods would emphasize changing the atmosphere of science methods classes to better suit the female students. Changes to foster feminine science methods include attending to the social issues of science and science teaching and emphasizing cooperation and caring rather than competition in all class activities.

An approach to elementary science methods based on the feminist science model may be the final answer to the question of what should an elementary science methods class taught by a

male instructor be like. But, my findings suggest that an approach based on the girl-friendly or feminine science model may better serve the needs and desires currently expressed by my students.

Conclusion

This interactive session was designed to explore three men's studies on their role in the preparation of women science teachers. The men professors' statements indicate that each participant has conducted research on his practice and has insights to contribute toward an emerging discourse in science education on the role of men in women teacher preparation. It is envisioned that the session's dialogue will have served to introduce and to demonstrate the power within the science education research community *of our interpretation* [italics added after the 1997NARST session] of a new research field, "men studies" (see, for example, Brod, 1987). Men studies have as their goal the need for men to be "re-cognized in some fundamental way " (p. 1). When done well, they "exemplify the best of deconstruction and reconstruction of masculinity" (p.1).

It is hoped that this session will have brought this issue of men professors teaching women prospective teachers of science to the greater attention of the science education research community so that considerable more research on this topic will be designed, conducted, and discussed at future NARST meetings.

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